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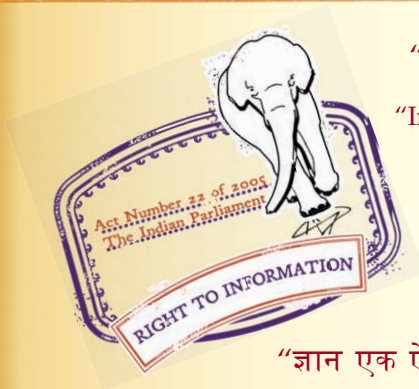
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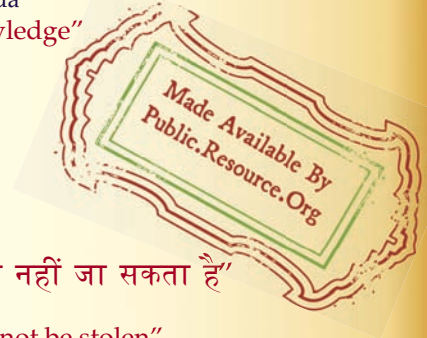
IS 9819-5 (1989): Line Output Transformers (Eht) Used with
Tv Picture Tubes, Part 5: Lot for Colour Picture Tubes
[LITD 5: Semiconductor and Other Electronic Components and
Devices]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SPECIFICATION FOR LINE OUTPUT
TRANSFORMERS (EHT) USED WITH
TV PICTURE TUBES**

PART 5 LOT FOR COLOUR PICTURE TUBES

भारतीय मानक

टी वी पिक्चर ट्यूबों के लिये प्रयुक्त लाइन आउटपुट
ट्रांसफार्मरों (इएचटी) की विशिष्टि

भाग 5 रंगीन पिक्चर ट्यूबों के लार्

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FOREWORD

This Indian Standard (Part 5) was adopted by the Bureau of Indian Standards on 1 November 1989, after the draft finalized by the Transformers and Inductors for Electronic Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

This standard (Part 5) shall be read in conjunction with IS : 9819 (Part 1)-1981.

In preparing this standard, assistance has been derived from STQC/CTVCOMP-II/86 'Specification for line output transformers used with 510 mm colour picture tubes', issued by STQC Directorate of Department of Electronics.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960. The number of significant place retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SPECIFICATION FOR LINE OUTPUT TRANSFORMERS (EHT) USED WITH TV PICTURE TUBES

PART 5 LOT FOR COLOUR PICTURE TUBES

1 SCOPE

1.1 This standard (Part 5) covers requirements and test methods for line output transformers (LOTs) designed for use with CTV receivers.

2 REFERENCES

2.1 The Indian Standard listed in Annex A are necessary adjuncts to this standard.

3 APPLICATION

3.1 Such transformers are required to provide EHT voltage and scanning drive for 510 mm, 29.1 mm or 22.5 mm neck diameter, 90° deflection angle colour picture tubes presenting 625 lines at 50 fields per second. Line output transformers are also called as flyback transformers (FBTs). The typical application schematic diagram is shown in Fig. 1.

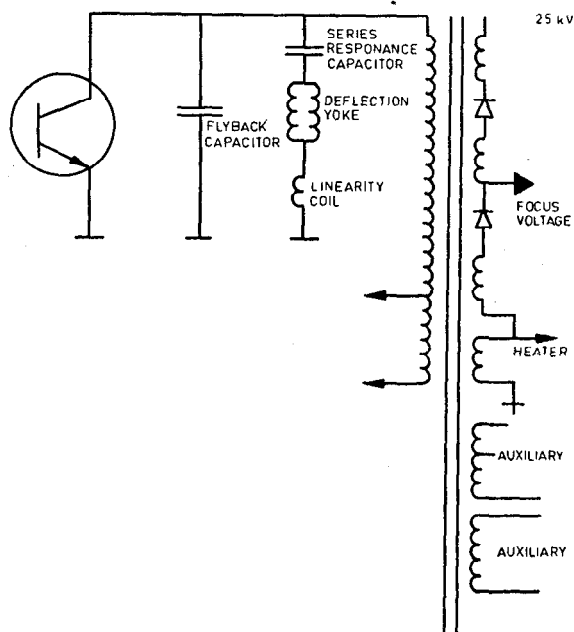


FIG. 1 SCHEMATIC DIAGRAM

4 DESCRIPTION

4.1 The LOT shall have primary, secondary, auxiliary and extra high tension (EHT) windings wound on a ferrite core with suitable resin impregnation/encapsulation. The mixing and pouring/encapsulation shall be carried out in vacuum as a continuous process.

5 DIMENSIONAL REQUIREMENTS

5.1 Dimensions

Dimensions shall be as agreed to between the user and the manufacturer.

5.2 Pin

The pin layout shall be viewed counter clockwise from the bottom of LOT. The pins should be made of 1.0 mm (Min) diameter steel cored copper/half hard brass wire with tin nickel plating.

5.3 The minimum length of various cables, wherever applicable, coming out of LOT shall be as follows:

Cable	Length	Voltage Rating of Cables
Anode cable	45 cm	40 kV dc
Focus cable	30 cm	30 kV dc
Screen cable	30 cm	30 kV dc

The EHT caps shall be made of silicon or chloroprene rubber.

5.4 All plastic and electrically heating metal parts shall be free from sharp edges and corners.

6 MOUNTING

6.1 The transformer shall be mountable on PCB and shall have provision for earthing the core.

7 ELECTRICAL REQUIREMENTS

7.1 The typical values of electrical parameters are specified in Table 1.

7.2 **Insulation Resistance** — Insulation resistance should not be less than 500 Mohms between core and coils and between coils. It should not be less than 2 000 Mohms between pins and resin surface. Both tests are to be done at 500 V dc applied for one minute.

7.3 Breakdown Voltage

7.3.1 The transformer shall withstand high voltage of 36 kV dc for one minute, with no arcing or other failures, applied between primary and secondary, or core and secondary.

7.3.2 The transformer shall withstand 1.5 kV rms, 50 Hz for one minute, with no arcing or other failures, applied between coils and core. Subsequent testing shall be carried out at 80 percent of the earlier test voltage.

Table 1 Electrical Parameters
(Clause 7.1)

Sl No.	Parameter	Typical Values	Limiting Values
1.	Nominal dc supply voltage horizontal section	110 — 120 V	—
2.	EHT output voltage at zero beam current	25.0 kV, dc	23 kV, <i>Min</i> 28 kV, <i>Max</i>
2.1	EHT load regulation (cut off to 1 mA beam current)	1.5 kV, dc	2.0 kV, dc <i>Max</i>
3.	Focus terminal voltage at zero beam current	26 — 33.5% (see Note 3)	—
4.	Collector voltage across primary	1 000 Vpp	1 200 Vpp, <i>Max</i>
5.	Pulse width	11.5 Sec	11.2 Sec <i>Min</i> 11.8 Sec <i>Max</i>
6.	Input current drawn by the horizontal output stage	To be specified by the user	—
	i) zero beam current		
	ii) 1 mA beam current		
7.	Screen voltage	150 V — 600 V, dc	—
8.	Ringing ratio	—	10%, <i>Max</i>
8.1	Decay characteristics	Second and third peak shall not exceed 66% and 33%, respectively of first peak and as in Fig. 4	—
9.	Primary inductance	3.5 to 6 mH	—
10.	Voltage and number of auxiliary windings	Optional (As mutually agreed to between the users and the manufacturer)	—

NOTES

1 All measurements to be taken at 1 mA beam current and all other windings loaded.

2 To measure the pulse width, measuring point is collector with supply and all other windings loaded as in Fig. 6.

3 In case, focus pot is integral part of LOT, the focus voltage measurable after focus point shall be 26-30 percent of EHT voltage to cover 22.5 mm and 29.1 mm colour picture tubes.

4 Test method for ringing ratio is given in Annex C.

7.4 Corona Test

The transformer shall withstand 36 kV obtained by increasing the input voltage line frequency for one minute with no corona, arcing or other failures. During or after the test, there should be no further need to increase the input power beyond what was already supplied (that is, at the commencement of the test) to obtain elevated voltage of 36 kV. The method for test is given in Annex B.

7.5 Flammability

The LOT shall meet the self-extinguishing and non-dripping requirements specified in IS : 11000 (Part 2/ Sec 2) : 1984. The durations of application of flame and burning shall be 10 s and 50 s, respectively. The test specimen shall not drip flaming particles that ignite the dry absorbent surgical cotton located 305 mm below the test specimen.

8 ENVIRONMENTAL/ENDURANCE TESTS REQUIREMENTS**8.1 Solderability Test****8.1.1 Solderability of Terminal Pins**

The solderability of terminal pins shall be tested according to Section 1 of IS 9000 (Part 18/Sec 1 to 3) : 1981.

8.1.2 Resistance to Soldering Test

The test shall be carried out on transformer windings as per Section 2 of IS : 9000 (Part 18/Sec 1 to 3) : 1981 with solder bath temperature of 350°C. The windings shall be allowed to remain in the solder bath for 10 seconds and at the end they shall be withdrawn from the solder bath at a rate of 20 to 30 mm/second.

The recovery period shall be 1 to 2 hours. After the recovery period, there shall not be any evidence of mechanical damage, when examined under 10 times magnifications. The IR shall not be less than that specified in 7.2 and inductance of windings shall be within the range as specified in Table 1.

8.2 Robustness of Terminations

All terminals and flying leads shall be subjected to tensile strength test in accordance with IS 9000 (Part 19/Sec 1) : 1978 by applying a force of 25 Newtons for 10 ± 1 sec.

8.3 Lead Bending Test

The high voltage output lead and focus output lead shall be put in the direction of the axis of the lead and pulled by weight (gradually up to 1 kg). Then the lead shall be bent as shown in Fig. 2. After 3 bends, there shall not be any damage to mechanical structure or change in electrical characteristics.

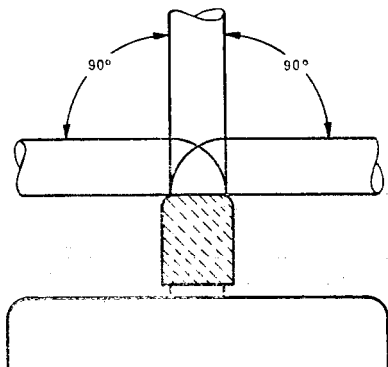


FIG. 2 LEAD BENDING TEST

8.4 Twisting Strength Test

Fix the product at the position 50 mm away from the outgoing surface of anode lead wire. Twist it by as much as 360° with reference to the axis of outgoing lead wire as an angle of rotation, and return it by turning by 360° in the opposite direction. Then, the product shall be free from any looseness or disconnection and meet the requirements of Table 1 and 7.2, 7.3 and 7.4. The speed of rotation shall be $360^\circ/5$ sec.

8.5 Vibration Test

It shall be carried out in accordance with IS 9000 (Part 8) : 1981. The vibration severity should be 10-150 Hz with acceleration of 2 g for a total duration of six hours (2 hours each on three principal axis).

8.6 Bump Test

It shall be carried out in accordance with IS 9000 (Part 7/Sec 2) : 1979 taking care that terminals are not stressed and that two samples are bumped in normal altitude of mounting and one each in the other two perpendicular axis. Samples shall be subjected to 1 000 bumps, at 400 m/sec², along each axis.

8.7 Shock Test

It shall be carried out according to Section 1 of IS 9000 (Part 7/Sec 1 to 5) : 1979, under the following conditions:

Peak acceleration	500 m/Sec ²
No. of shocks	3 per direction
No. of directions	6

8.8 Dry Heat Test

The LOT shall be subjected to 96 hours of the dry heat test at 100°C in accordance with Section 4 of IS 9000 (Part 3/Sec 1 to 5) : 1977. The LOT shall be in unloaded condition during the test. Recovery period shall be one-and-a-half hour.

8.9 Damp Heat (Cyclic) Test

The LOT shall be subjected to six cycles of 12 hours each of damp heat test at 40°C and 95 percent relative humidity in accordance with Section 2 of IS 9000 (Part 5/Sec 1 and 2) : 1981. The LOT shall be on full load during the test. After recovery (one and a half hour) the LOT shall be visually examined for any damage/deterioration.

8.10 Cold Test

It shall be carried out in accordance with Section 2 of IS 9000 (Part 2/Sec 1 to 4) : 1977 at -25°C for 96 hours.

8.11 Damp Heat (Steady State)

The LOT shall be subjected to damp heat (steady state) test in accordance with IS 9000 (Part 4) : 1979 at 55°C , 95% RH for 21 days.

8.12 Salt Mist Test

It shall be carried out as per IS 9000 (Part 11) : 1983 at 40°C for 96 hours.

8.13 High Temperature Endurance Test

It shall be carried out in accordance with IS 9185 (Part 1) : 1979. The windings shall be loaded at its rated voltage and current for 1.5 h and shall remain unloaded for 0.5 h. The test shall be carried out at $55 \pm 2^\circ\text{C}$ for a duration of 168 hours.

The requirements given at SI No. 2, 2.1, 5, 6, 8 and 9 of Table 1 shall be checked after this test.

8.14 High Humidity Endurance Test

This test shall be carried out at 40°C , 95% RH for 1 000 h. The windings shall be loaded in on and off cycles at its rated voltage and current for 1.5 h and shall remain unloaded for 0.5 h. The requirements of 7.2, 7.4 and those given at SI No. 2, 2.1, 5, 6, 8, 9 and 10 of Table 1 shall be checked after the test.

8.15 Cyclic Temperature Humidity Test

The test shall be carried for 30 cycles. One cycle shall consist of 1 h, -10°C , LOT non-operating, and 1 h, $+40^\circ\text{C}$ at 95% RH, LOT operating at rated voltage.

After the test, there shall be no voltage breakdown and deterioration in insulation characteristics.

8.16 Temperatures Cycling Test

The LOT shall be subjected to 30 cycles, each comprising testing at -30°C for 2 h, non-operating and at 100°C for 2 h non-operating. The requirements of 7.2, 7.4 and those given at SI No. 2, 2.1, 5, 6, 8, 9 and 10 of Table 1 shall be checked after the test.

9 MARKING REQUIREMENTS

9.1 See 6 of IS 9819 (Part 1) : 1981.

10 GENERAL CONDITIONS FOR MEASUREMENTS**10.1 General**

See 7.1 of IS 9819 (Part 1) : 1981.

10.2 Reference Conditions of Measurements

In such cases where the characteristics are sensitive to ambient conditions, the following reference conditions shall be maintained during the measurements:

Temperature	$25 \pm 2^{\circ}\text{C}$
Relative humidity	50 ± 5 percent
Air pressure	860-1 050 m bar

11 TESTS**11.1 Classification of Tests****11.1.1 Types Tests**

The tests specified in Table 2 shall constitute type tests in the sequence mentioned therein.

11.1.1.1 Number of samples

For type tests, 12 samples shall be selected preferably at random from a regular production lot and shall be subjected to various tests as specified in Table 2.

Table 2 Schedule of Type Tests
(Clause 11.1.1.1)

Group No.	Test	Ref to Clause in this Standard	No. of Samples
0.	Dimensional requirements	5	All
	Electrical requirements (except flammability)	7	
	Marking	9	
1.	Solderability	8.1	3
	Robustness of termination	8.2	
	Lead bending test	8.3	
	Twisting strength test	8.4	
2.	Bump	8.6	
	Vibration	8.5	
	Shock	8.7	
	Dry heat	8.8	
	Damp heat (cyclic)	8.9	
	Cold test	8.10	
3.	Damp heat (steady state)	8.11	1
4.	High temperature endurance test	8.13	2
5.	Flammability	7.5	1
6.	Salt mist	8.12	1
7.	High humidity endurance test	8.14	2
8.	Cyclic temperature humidity test	8.15	1
9.	Temperature cycling test	8.16	1

After each test in the group the LOT shall be visually examined for any damage or deterioration. The following functional checks shall be made, unless otherwise specified, along with test method, after group 1, 2 and 4 and LOT shall meet the requirements given for each test.

1. Visual examination,
2. Continuity of windings,
3. EHT voltage,
4. Insulation resistance, and
5. Breakdown voltage (80% of specified voltage).

11.1.1.2 Criteria of acceptance

There shall be no single failure in any of the type tests. In case of failure, twice the number of samples shall be taken and subjected to the tests in which failure has occurred and other tests that have bearing on the test results. No failure shall be permitted in the retests.

11.1.2 Routine Tests

The following shall constitute the routine tests and

shall be carried out on each and every LOT:

- a) Visual examination,
- b) EHT voltage,
- c) Focus voltage,
- d) Ringing ratio/pulse width,
- e) Current drawn by LOT at zero beam current and 1 mA beam current,
- f) Auxiliary voltage, and
- g) Inductance.

11.1.3 Acceptance Tests

The following shall constitute the acceptance tests which shall be carried out on LOTs that have successfully passed routine tests:

- a) Visual examination;
- b) Insulation resistance; and
- c) Breakdown voltage.

11.1.3.1 Samples shall be selected and subjected to acceptance tests to ascertain the conformity of each lot to the requirement specified. A recommended sampling plan and acceptance criteria is given in Annex D.

ANNEX A

(Clause 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
IS 9000	Basic environmental testing procedures for electronic and electrical items	IS 9000 (Part 11) : 1983	Salt mist test
IS 9000 (Part 2/ Sec 1 to 4) : 1977	Cold test, Sec 2 Cold test for non-heating dissipating items with sudden change of temperature	IS 9000 (Part 18/ Sec 1 to 3) : 1981	Solderability test
IS 9000 (Part 3/ Sec 1 to 5) : 1977	Dry heat test, Section 4 Dry heat test for heat dissipating items with sudden change of temperature	IS 9000 (Part 19/ Sec 1 to 5) : 1986	Test U: Robustness of terminations and integral mounting devices, Section 1 Test Ua1: Tensile
IS 9000 (Part 4) : 1979	Damp heat (steady state)	IS 9185 (Part 1) : 1979	Endurance (life) test for electronic and electrical components: Part 1 - Thermal endurance
IS 9000 (Part 5/ Sec 1 and 2) : 1981	Damp heat (cyclic) test, Sec 2 12+12h cycles	IS 9819 (Part 1) : 1981	Specification for line output transformers (EHT) used with TV picture tubes: Part 1 General requirements and tests
IS 9000 (Part 7/ Sec 1 to 5) : 1979	Impact test; Section 1 Shock Section 2 Bump	IS 11000 (Part 2/ Sec 2) : 1984	Fire hazard testing: Part 2 Test methods, Section 2 Needle flame test
IS 9000 (Part 8) : 1981	Vibration (sinusoidal) test		

ANNEX B

(Clause 7.4)

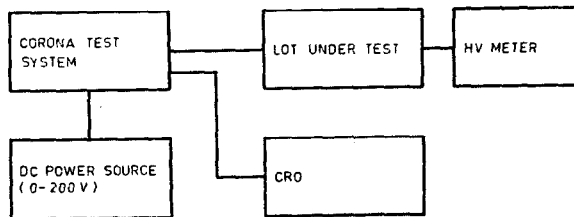
CORONA TEST METHOD**B-1 CORONA TEST METHOD**

FIG. 3 BLOCK DIAGRAM FOR CORONA TEST

B-1.1 The test method for carrying out this test shall consist of the following steps:

- i) Connect LOT as shown in Fig. 3.
- ii) Energise the input winding of LOT and keep all other windings open.
- iii) Raise the input supply so that EHT output is 36 kV and maintain it for one minute.
- iv) Observe the discharge, if any, on CRO.

ANNEX C

(Table 1)

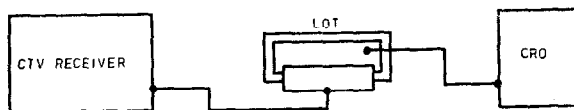
TEST METHOD FOR RINGING RATIO**C-1 TEST METHOD FOR RINGING RATIO**

FIG. 4 BLOCK DIAGRAM FOR RINGING RATIO

C-1.1 The test method for measurement of ringing ratio shall consist of the following steps:

- i) Connect the set up as shown in Fig. 4 and energise the LOT and CTV receiver.
- ii) Hold the 10 : 1 probe of CRO in the gap between the poles of LOT and winding as shown in Fig. 4.
- iii) Adjust the probe so that the pick up is maximum.
- iv) The pick up waveform shall appear on the screen of CRO as shown in Fig. 5.

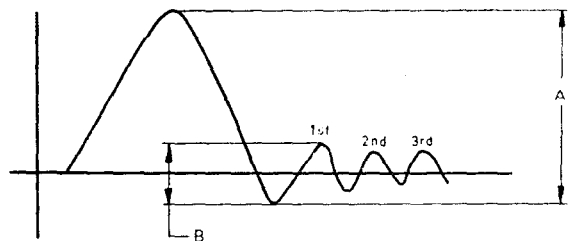


FIG. 5 DECAY CHARACTERISTICS

- v) The ringing ratio shall be measured by the formula:

$$\text{Ringing Ratio (percent)} = \frac{B}{A} \times 100$$

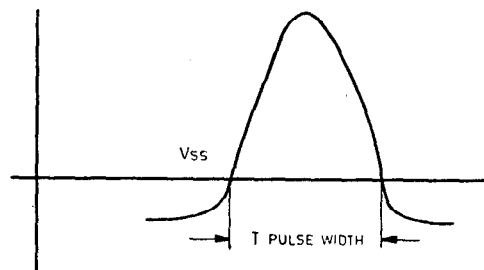


FIG. 6 MEASUREMENT OF PULSE WIDTH

ANNEX D

(Clause 11.1.3.1)

SAMPLING AND CRITERIA FOR CONFORMITY

D-1 LOT

D-1.1 All the LOTs of the same model and type having the same design and manufactured by the same technique under essentially similar conditions of production.

D-1.1.1 Samples shall be taken and tested to ascertain the conformity of each lot for acceptance tests.

D-2 SCALE OF SAMPLING

D-2.1 LOTs shall be taken at random according to column 2, 3 and 4 of Table 3.

D-3 NUMBERS OF TESTS AND CRITERIA FOR CONFORMITY

D-3.1 LOTs shall be drawn from each lot according to col 2 and 3 of Table 3 and subjected to the acceptance test specified in 11.1.3. If a LOT fails in any one of the acceptance tests, it shall be called a defective. If the number of defectives found in the 'first samples' (see col 3) is zero (see col 6), the lot shall be considered as conforming to the acceptance. If the number of defectives is equal to or greater than 2 (see col 7), the lot shall be considered as not conforming to the acceptance tests.

D-3.2 If the number of defectives is equal to one, further samples of LOTs shall be taken according to col 4 of Table 3 and tested for all the acceptance tests. If the number of defectives in the combined samples (see col 5), is less than two (see col 7), the lot shall be considered as conforming to the acceptance tests otherwise rejected.

Table 3 Sampling Plan
(Clause B-2.1)

Sl No.	Lot Size (N)	First Sample (N ₁)	Second Sample (N ₂)	Combined Sample (N ₁ +N ₂)	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Up to 150	5	5	10	0	2
2.	151 to 300	8	8	16	0	2
3.	301 and above	13	13	26	0	2

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Doc : No. LTD 8 (1205)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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